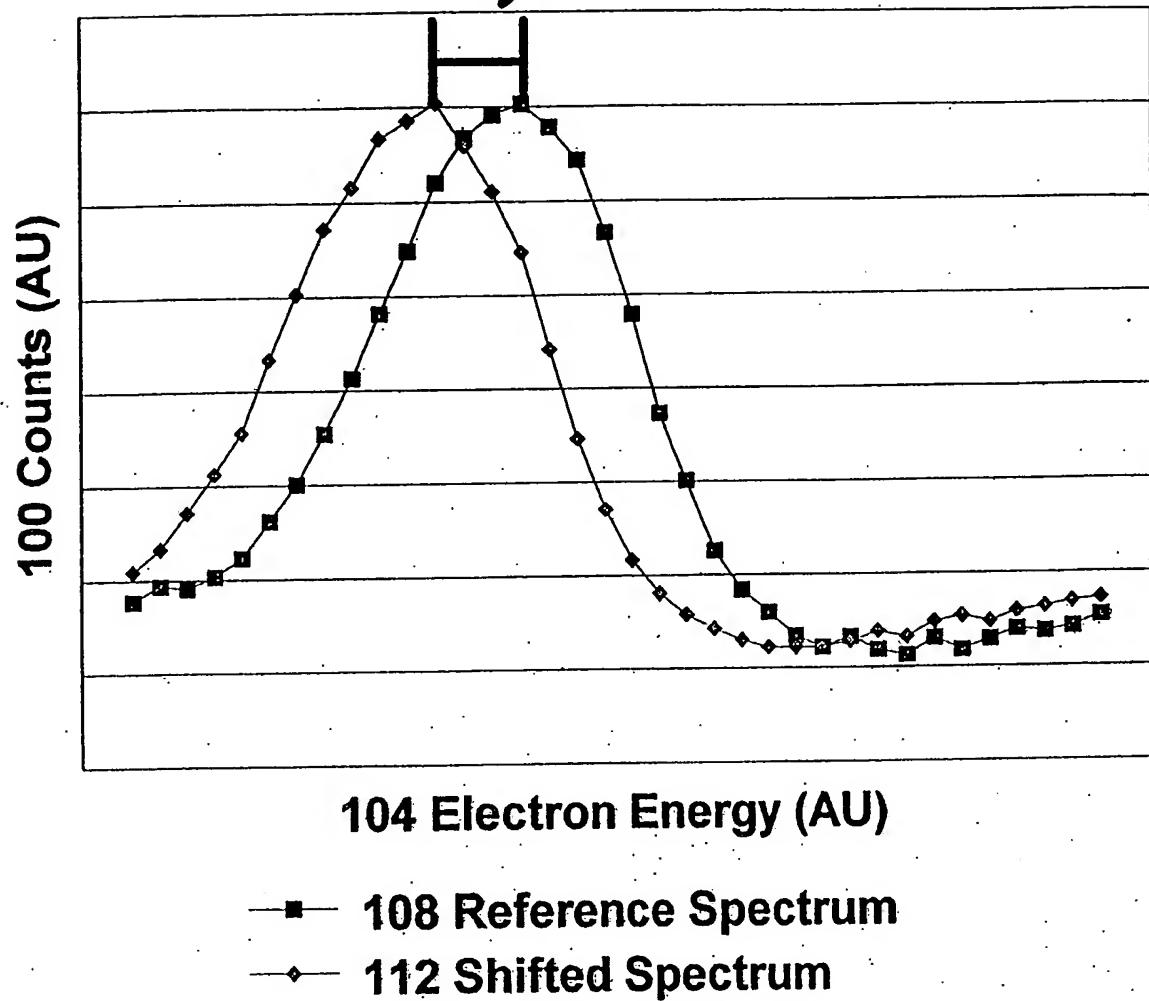


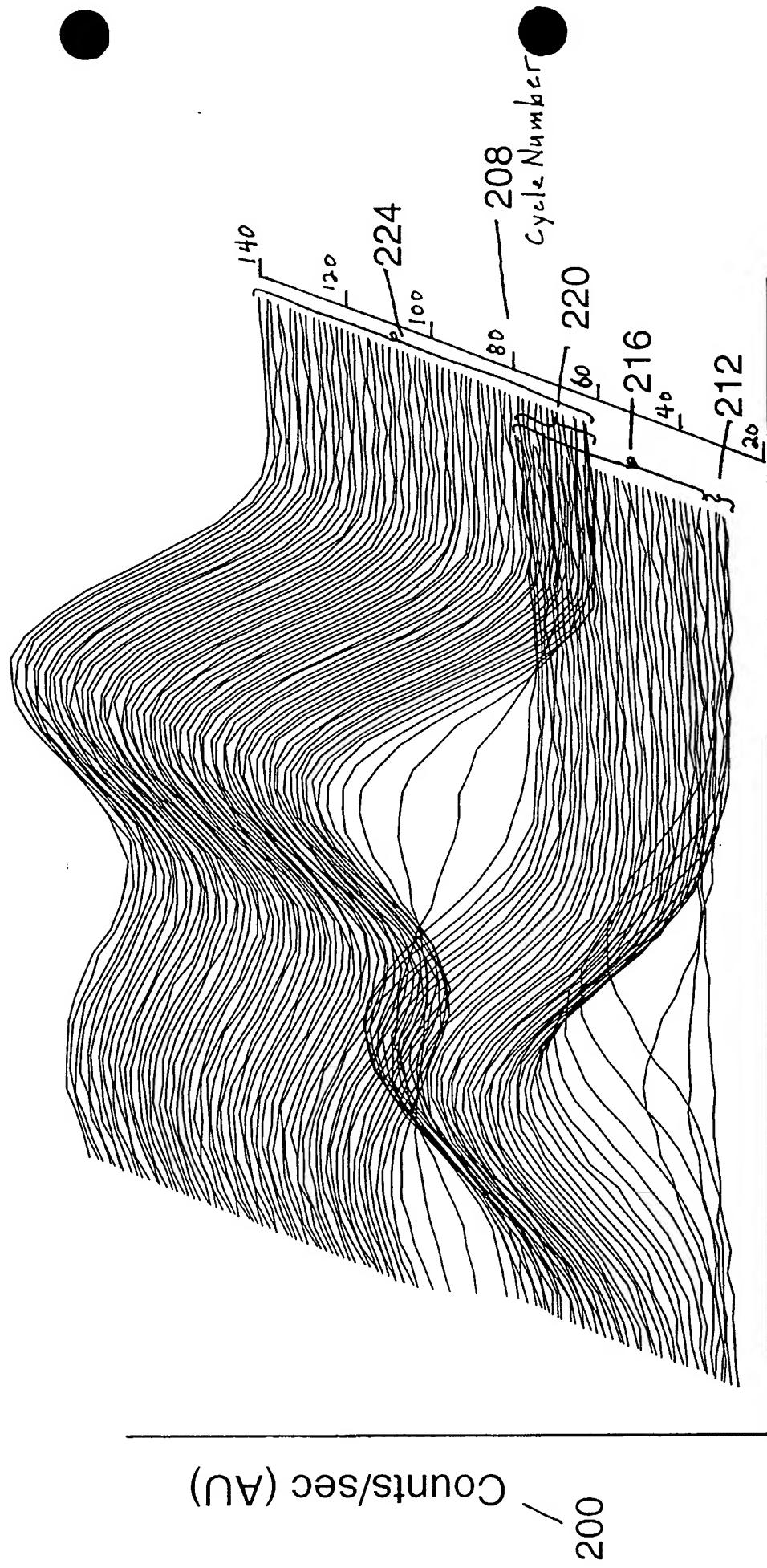
### 116 Spectral Shift



(PRIOR ART)

Fig. 1

# Spectra for Depth Profile of Charging $\text{SiO}_2$ on Si (Si KLL Auger Spectra) (PRIOR ART)



204 — Kinetic Energy, eV

Fig. 2

Profiles of Scaled Target-Factor Weighting Factors from Factor Analysis  
of Uncompensated Auger Spectra from Charging SiO<sub>2</sub> on Si Substrate  
(PRIOR ART)

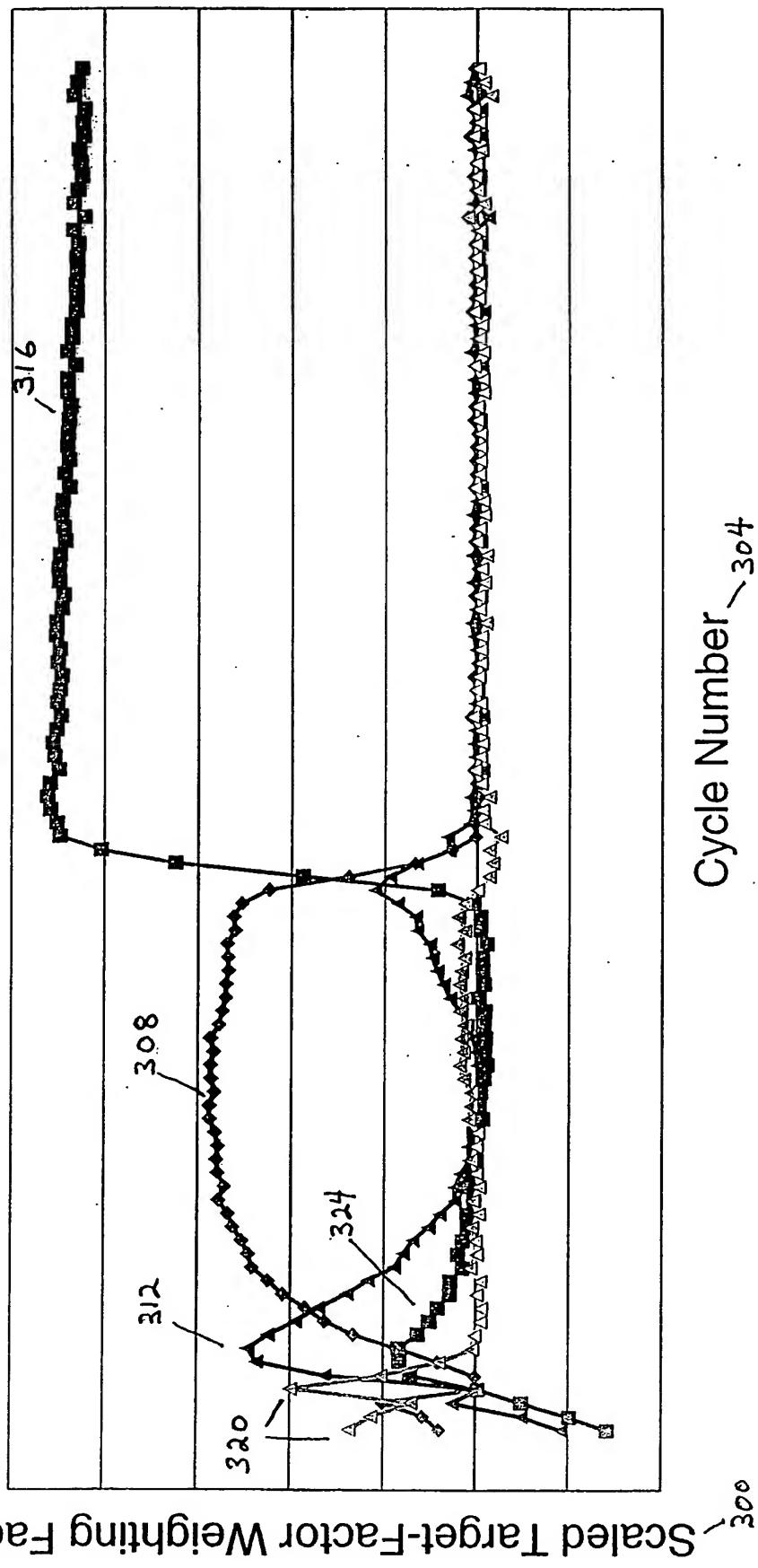


Fig. 3

400

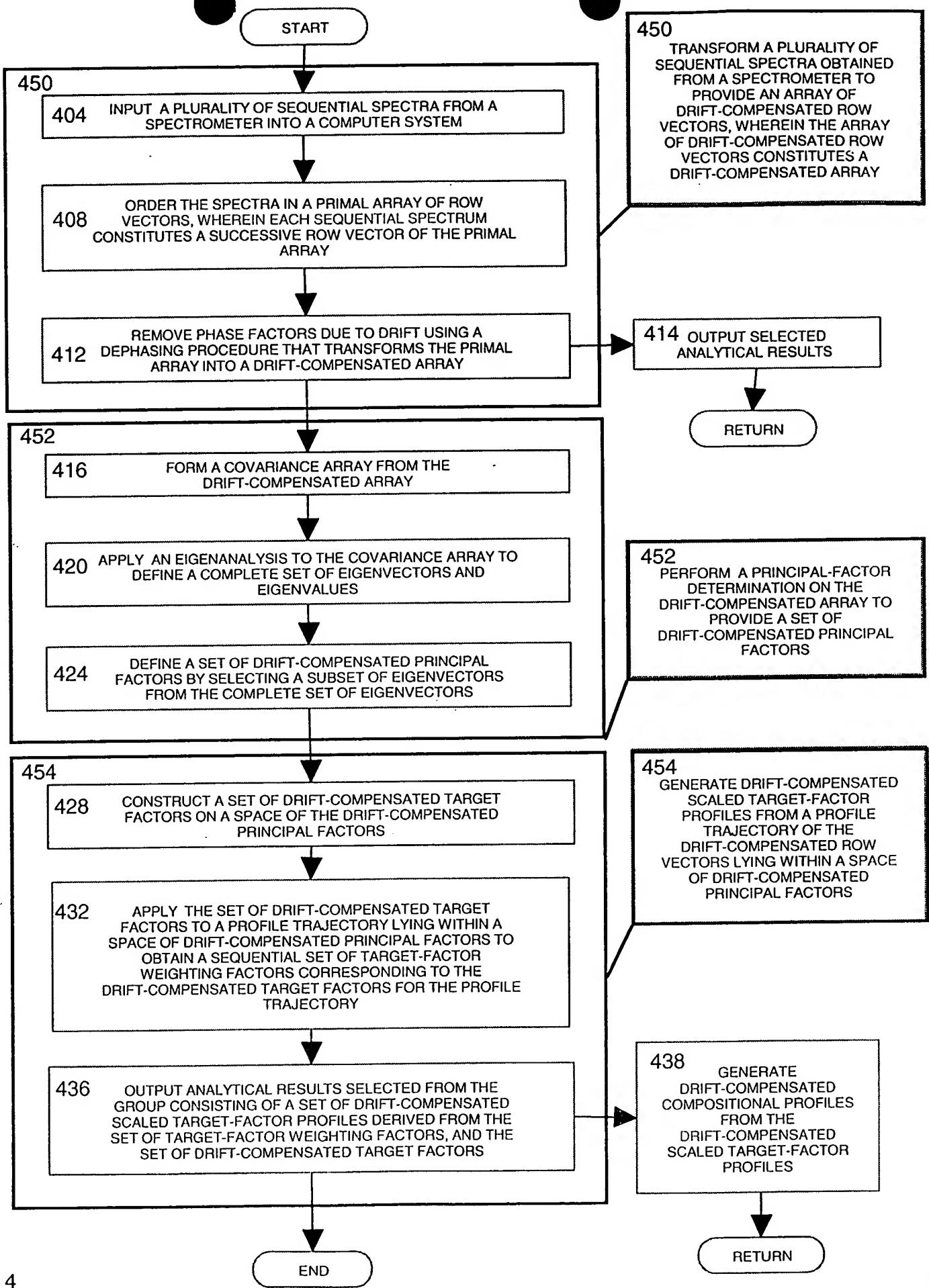


Fig. 4

## Moduli of Fourier-transformed Spectra for Depth Profile of Charging $\text{SiO}_2$ on Si

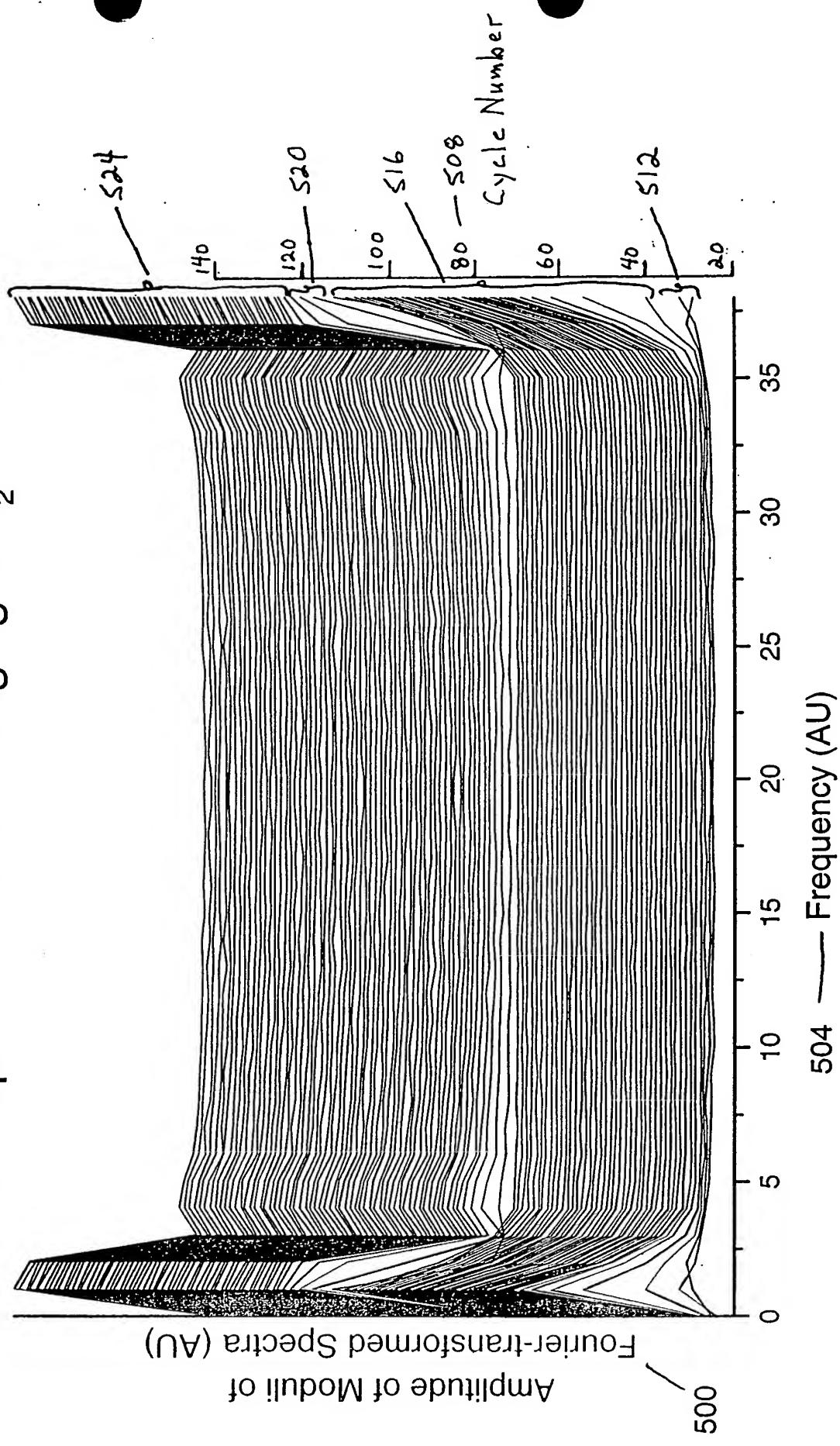


Fig. 5

Profiles of Scaled Target-Factor Weighting Factors from Factor Analysis of Moduli  
of Fast-Fourier-Transformed Auger Spectra from Charging SiO<sub>2</sub> on Si Substrate

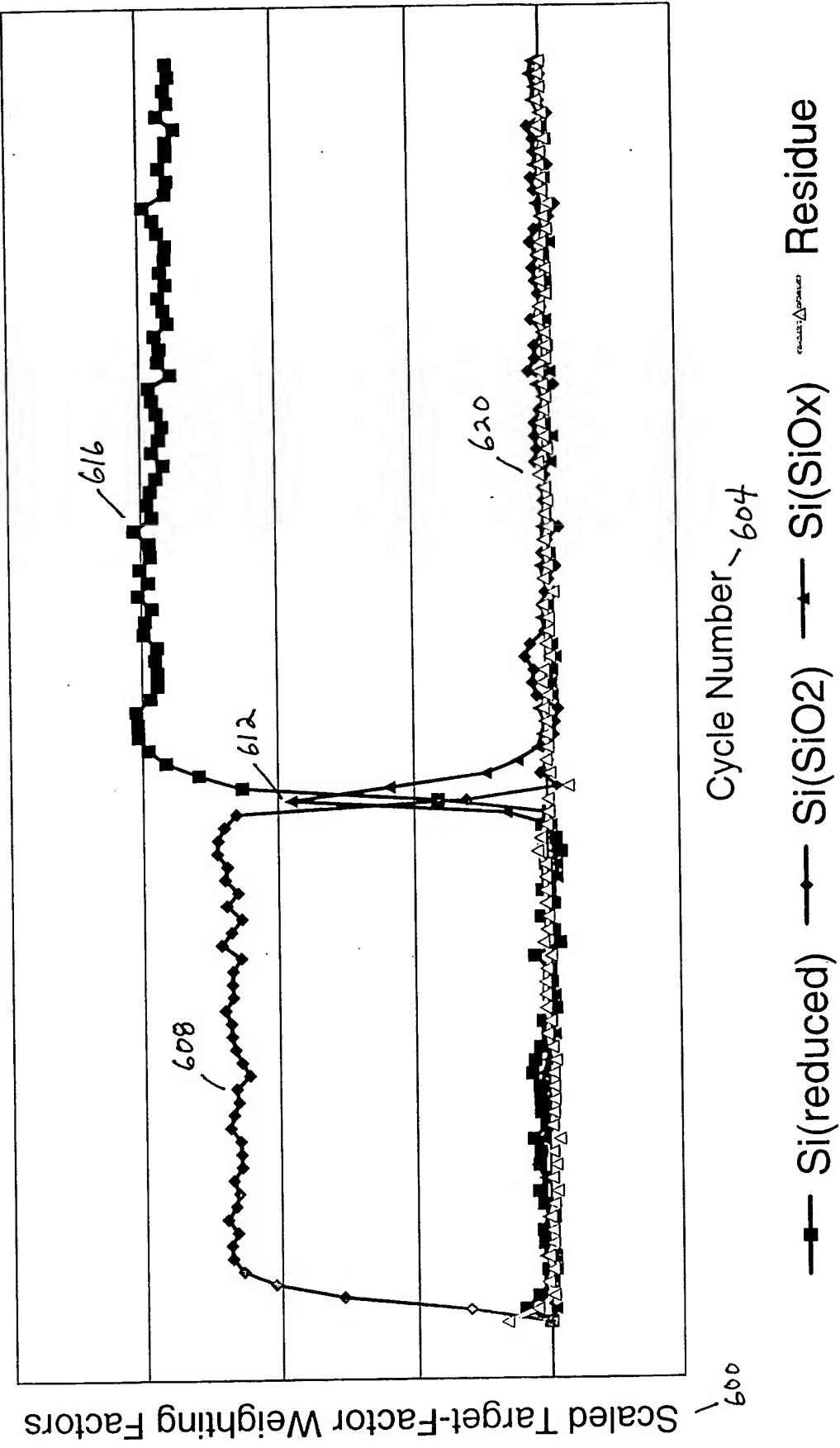


Fig. 6

# Drift-Compensated Spectra Synthesized from Selected Reference Spectra Fit to Primal Spectra for Depth Profile of Charging $\text{SiO}_2$ on Si

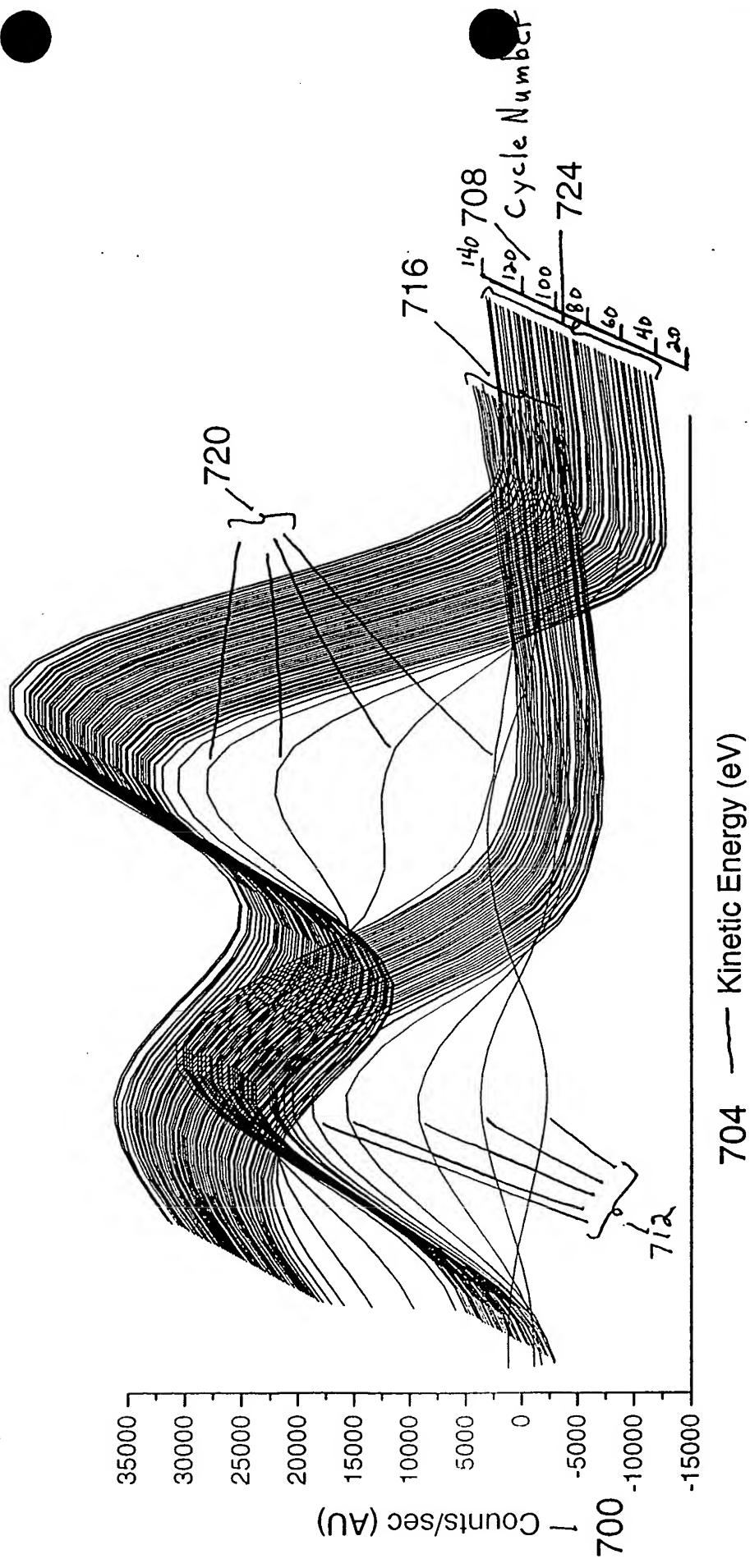


Fig. 7

Profiles of Scaled Target-Factor Weighting Factors from Nonlinear-  
Least-Squares Fitting of Selected Reference Spectra to Primal Spectra and  
Profile of Principle Residue Weighting Factor from Eigenanalysis of Residues

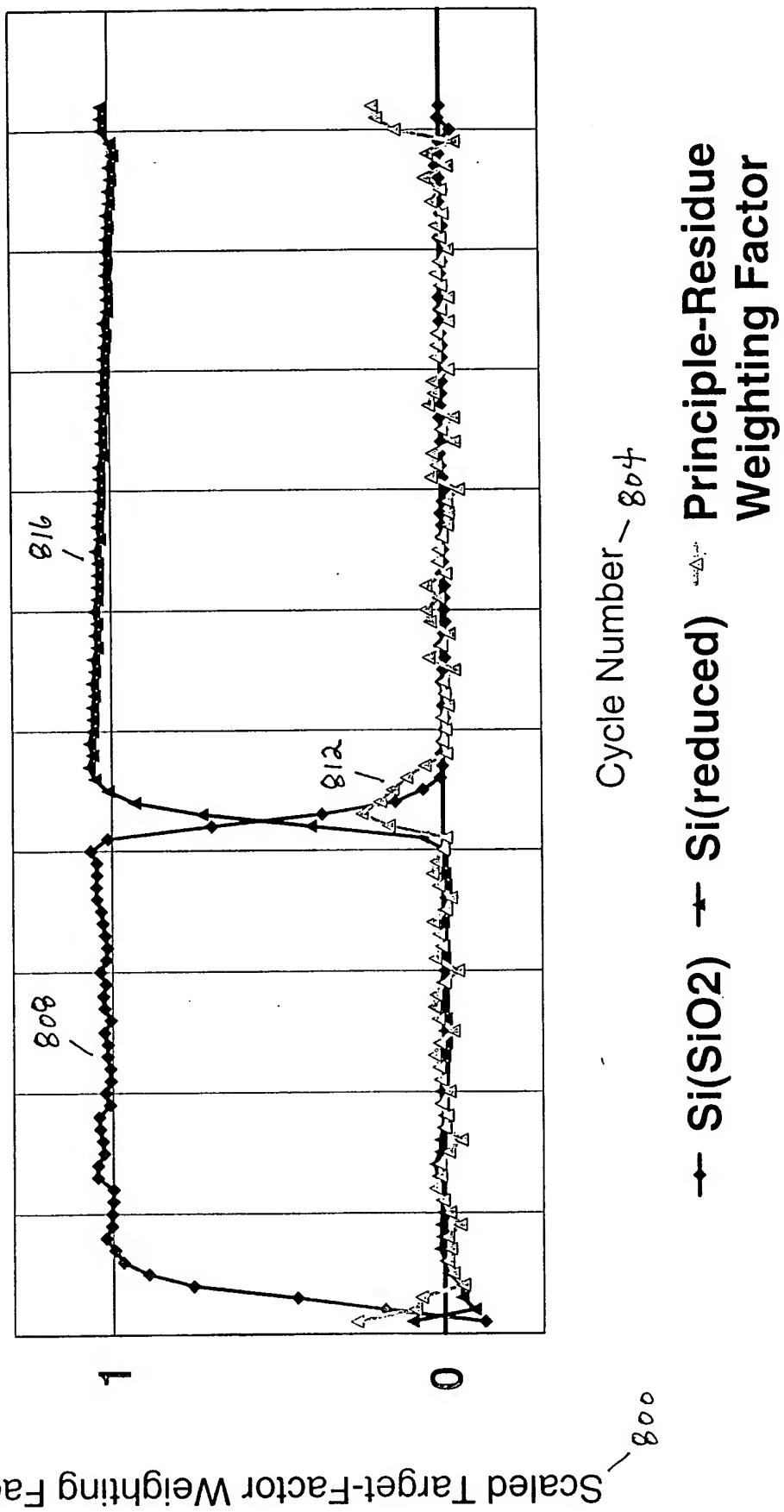


Fig. 8

## Profiles of Phase Factors for Selected Reference Spectra Obtained from Fitting to Primal Spectra

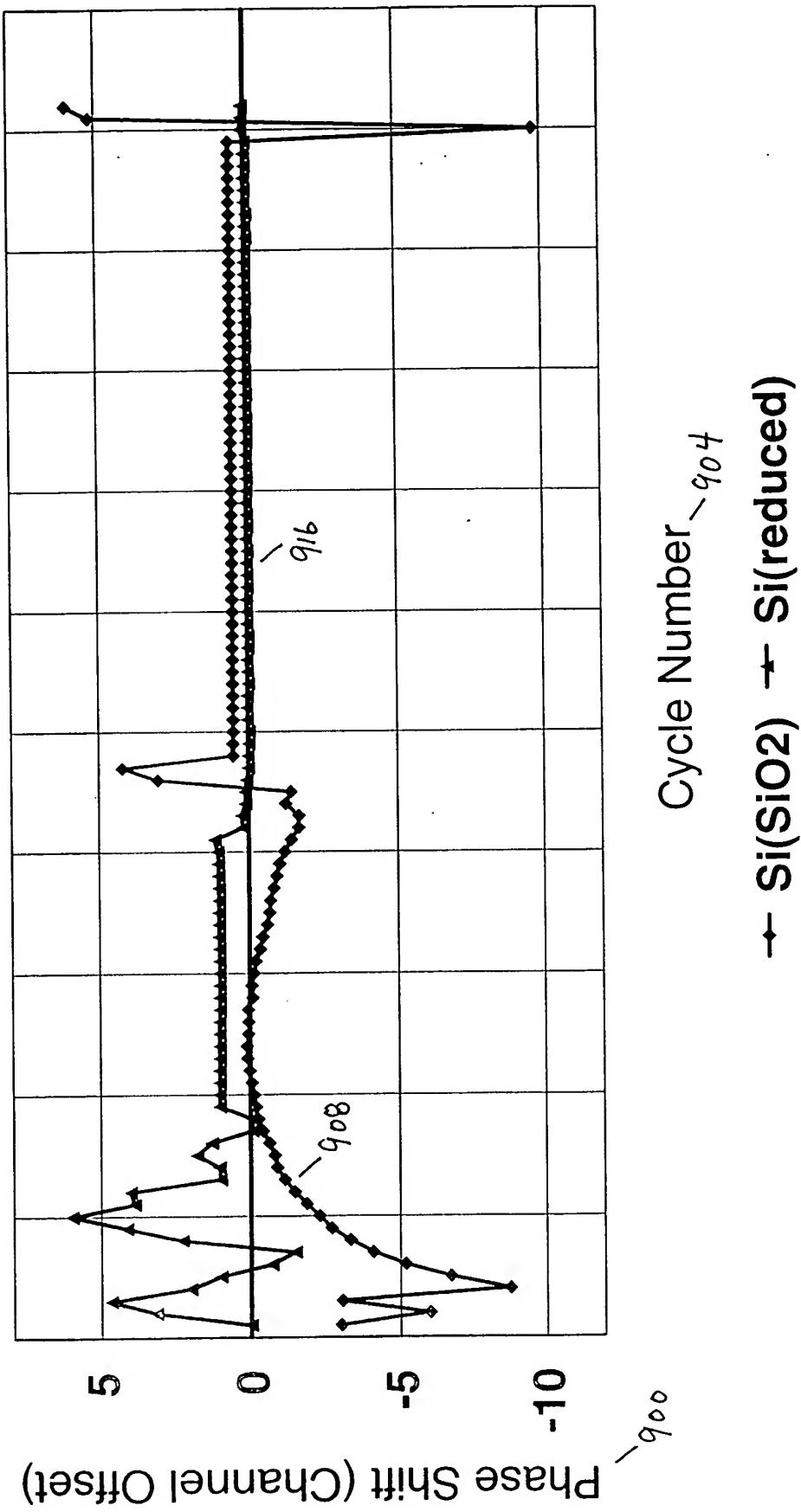


Fig. 9

1000

412

1010 APPLY A FOURIER TRANSFORM TO THE SPECTRA IN THE PRIMAL ARRAY OF ROW VECTORS FORMING AN ARRAY OF FOURIER-TRANSFORMED ROW VECTORS



1020 MULTIPLY EACH FOURIER-TRANSFORMED ROW VECTOR BY A COMPLEX CONJUGATE OF EACH FOURIER-TRANSFORMED ROW VECTOR TO FORM A SQUARED MODULI VECTOR THEREBY REMOVING PHASE FACTORS DUE TO DRIFT



1030 TAKE THE SQUARE ROOT OF EACH ELEMENT OF THE SQUARED MODULI VECTOR TO CREATE A CORRESPONDING MODULI VECTOR



1040 FORM A DRIFT-COMPENSATED ARRAY OF MODULI VECTORS BY SUCCESSIVELY SEQUENCING THE MODULI VECTORS AS SUCCESSIVE DRIFT-COMPENSATED ROW VECTORS IN A DRIFT-COMPENSATED ARRAY, WHEREIN THE MODULI VECTORS CONSTITUTE MODULI OF FOURIER-TRANSFORMED SPECTRA

412

REMOVE PHASE FACTORS DUE TO DRIFT USING A DEPHASING PROCEDURE THAT TRANSFORMS THE PRIMAL ARRAY INTO A DRIFT-COMPENSATED ARRAY

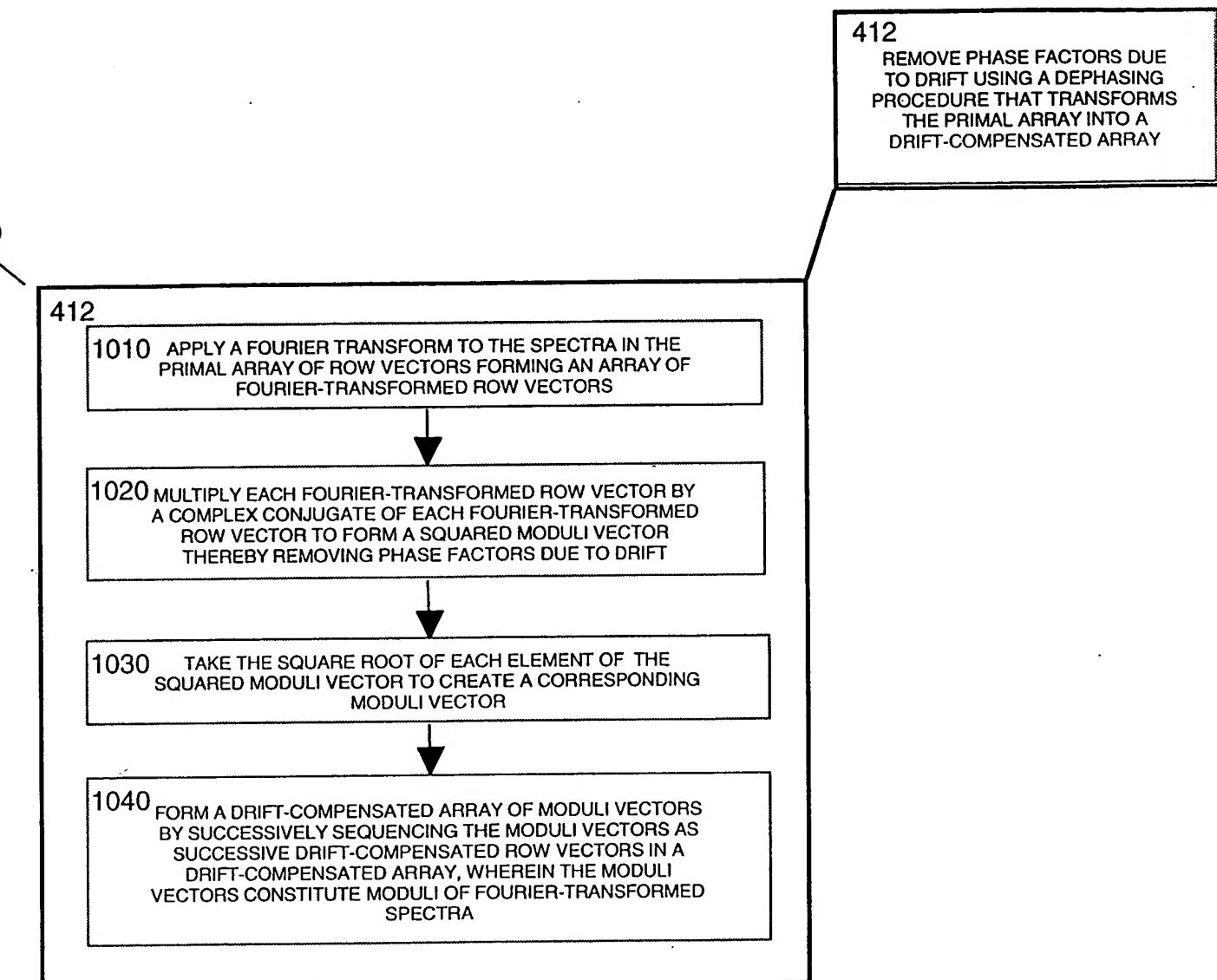


Fig. 10

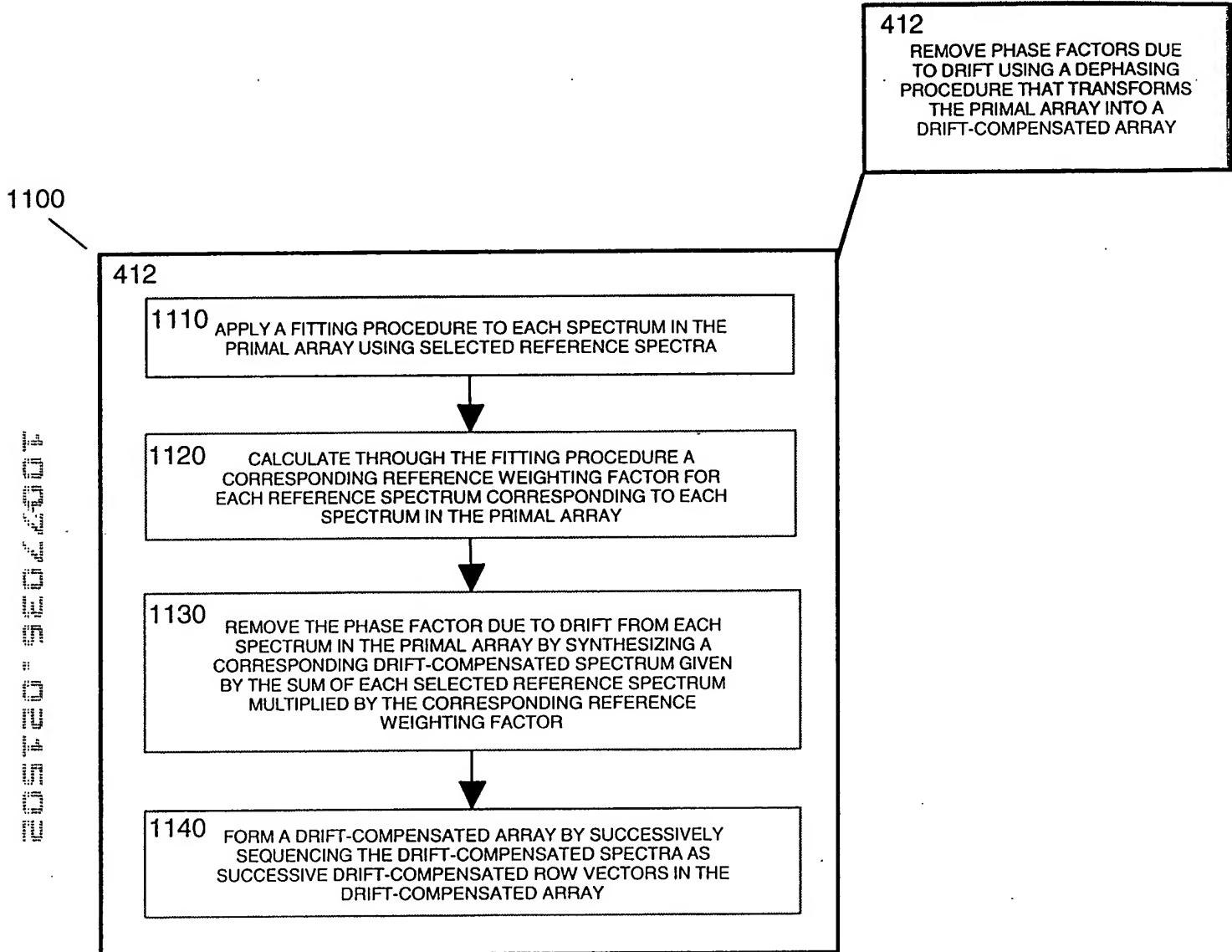


Fig. 11

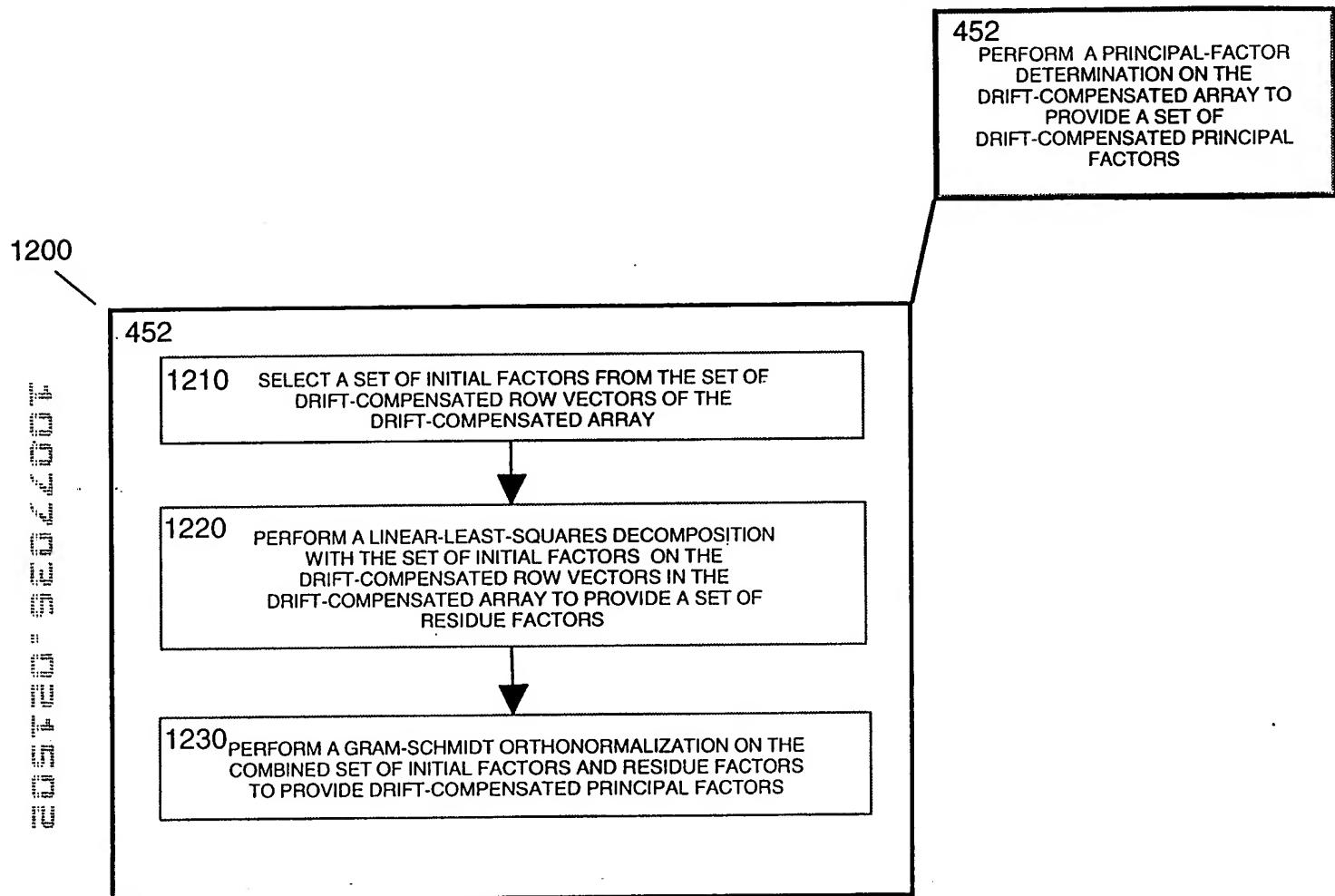


Fig. 12

1300  
428  
1310  
1320  
1330

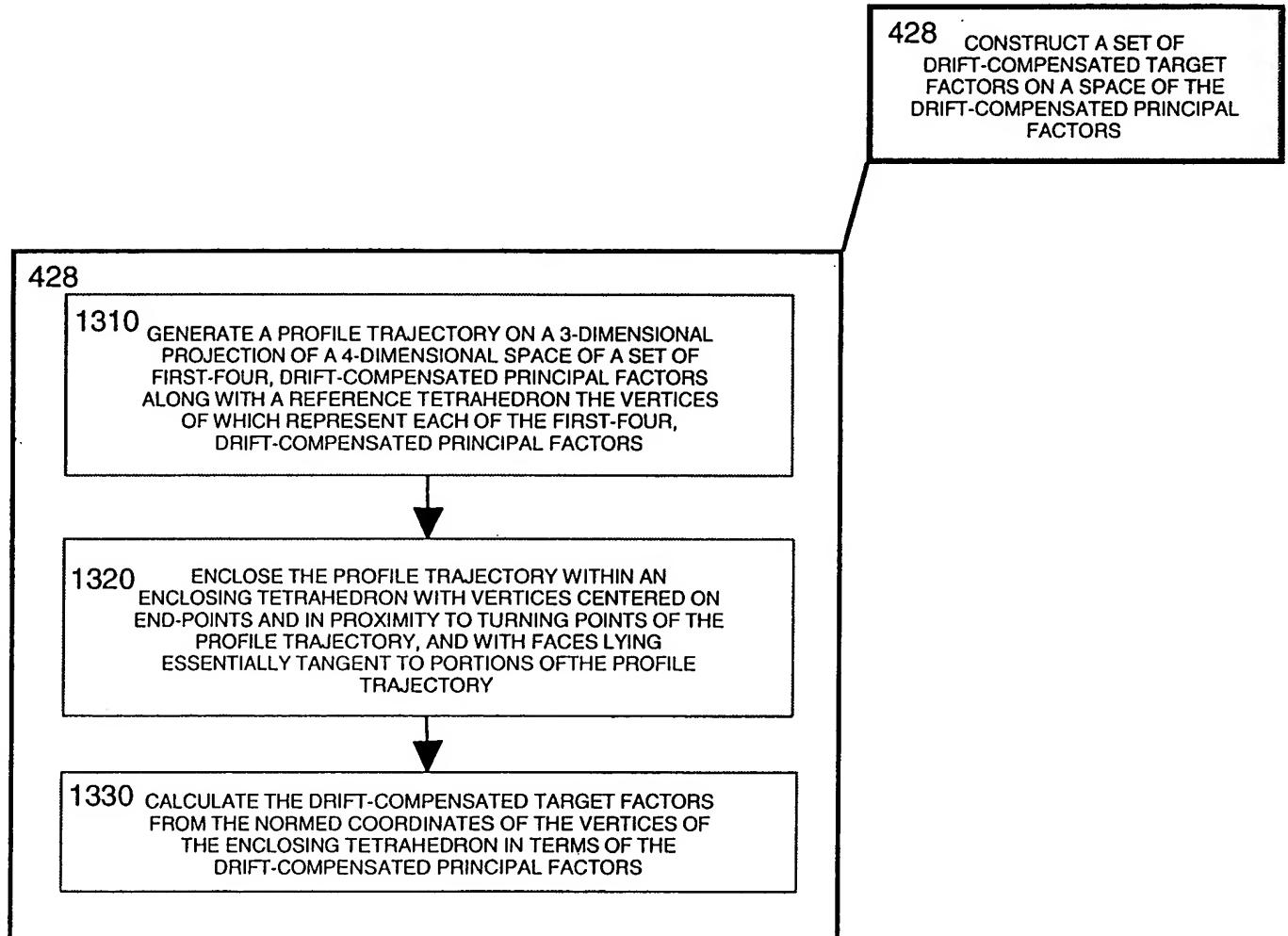


Fig. 13

1400

1310

1410 CALCULATE 4-SPACE COORDINATES OF A PROFILE TRAJECTORY OF DRIFT-COMPENSATED TARGET-FACTOR PROFILES ON A 4-DIMENSIONAL SPACE TO PRODUCE FOUR COORDINATES FOR EACH POINT IN THE PROFILE TRAJECTORY, ONE COORDINATE FOR EACH OF THE FIRST-FOUR, DRIFT-COMPENSATED PRINCIPAL FACTORS

1420 REDUCE THE DIMENSIONALITY OF THE COORDINATES OF THE PROFILE TRAJECTORY BY DIVIDING EACH COORDINATE BY A SUM OF ALL FOUR 4-SPACE COORDINATES TO PRODUCE NORMED COORDINATES FOR THE PROFILE TRAJECTORY

1430 PLOT THE NORMED COORDINATES FOR THE PROFILE TRAJECTORY IN A 3-DIMENSIONAL SPACE THE COORDINATES AXES OF WHICH ARE EDGES OF A REFERENCE TETRAHEDRON, THE VERTICES OF WHICH CORRESPOND TO UNIT VALUES FOR EACH OF THE FIRST-FOUR, DRIFT-COMPENSATED PRINCIPAL FACTORS IN A MANNER ANALOGOUS TO PLOTTING OF COORDINATES ON A QUATERNARY PHASE DIAGRAM

1310

GENERATE A PROFILE TRAJECTORY ON A 3-DIMENSIONAL PROJECTION OF A 4-DIMENSIONAL SPACE OF A FIRST-FOUR, DRIFT-COMPENSATED PRINCIPAL FACTORS ALONG WITH A REFERENCE TETRAHEDRON THE VERTICES OF WHICH REPRESENT EACH OF THE FIRST-FOUR, DRIFT-COMPENSATED PRINCIPAL FACTORS

Fig. 14

1320 & 1330

ENCLOSE THE PROFILE TRAJECTORY WITHIN AN ENCLOSING TETRAHEDRON WITH VERTICES CENTERED ON END-POINTS AND IN PROXIMITY TO TURNING POINTS OF THE PROFILE TRAJECTORY, AND WITH FACES LYING ESSENTIALLY TANGENT TO PORTIONS OF THE PROFILE TRAJECTORY; AND, CALCULATE THE DRIFT-COMPENSATED TARGET FACTORS FROM THE NORMED COORDINATES OF THE VERTICES OF THE ENCLOSING TETRAHEDRON IN TERMS OF THE DRIFT-COMPENSATED PRINCIPAL FACTORS

1500

1320 & 1330

- 1510 PLACE VERTICES OF AN ENCLOSING TETRAHEDRON AT LOCI OF HEAVY POINT CONCENTRATIONS OF A PROFILE TRAJECTORY
- 1520 ADJUST THE EDGES OF AN ENCLOSING TETRAHEDRON TO LIE ALONG ESSENTIALLY STRAIGHT LINE SEGMENTS
- 1530 PLACE REMAINING VERTICES OF AN ENCLOSING TETRAHEDRON SO AS TO LIE NEAR THE TURNING POINTS OF THE PROFILE TRAJECTORY
- 1540 ADJUST THE FACES OF THE ENCLOSING TETRAHEDRON TO LIE ALONG CURVED SEGMENTS JOINING A TURNING POINT AND ESSENTIALLY STRAIGHT LINE SEGMENTS OF THE PROFILE TRAJECTORY

1501  
1502  
1503  
1504  
1505  
1506  
1507  
1508  
1509  
1510

Fig. 15

1600

1610

DISPLAY ON A COMPUTER MONITOR THE PROFILE TRAJECTORY OF THE PROJECTIONS OF A SEQUENCE OF ROW VECTORS AND THE REFERENCE TETRAHEDRON ESSENTIALLY SPANNING THE SPACE OF THE PROJECTIONS OF THE FIRST-FOUR, DRIFT-COMPENSATED PRINCIPAL FACTORS

1620

GENERATE AN ENCLOSING TETRAHEDRON BY STARTING WITH A COPY OF THE REFERENCE TETRAHEDRON AND MOVING ITS VERTICES TO ENCLOSE THE PROFILE TRAJECTORY USING SOFTWARE BASED ON METHODS WELL KNOWN IN THE ART OF THE DISPLAY OF GRAPHICALLY GENERATED COMPUTER OBJECTS

1630

DRAG THE VERTICES OF THE ENCLOSING TETRAHEDRON TO THE LOCI OF HEAVY POINT CONCENTRATIONS IN THE PROFILE TRAJECTORY

1640

DRAG ANY REMAINING VERTICES OF THE ENCLOSING TETRAHEDRON TO POSITION THEM IN THE VICINITY OF ANY TURNING POINTS IN THE PROFILE TRAJECTORY SO THAT ESSENTIALLY STRAIGHT LINE SEGMENTS LIE IN CLOSE PROXIMITY TO EDGES OF THE ENCLOSING TETRAHEDRON ; AND, PLACE THE FACES OF THE ENCLOSING TETRAHEDRON ON OR IN CLOSE PROXIMITY TO ANY CURVED PORTIONS OF THE TRAJECTORY THAT CONNECT TURNING POINTS

1650

APPLY MINOR ADJUSTMENTS TO THE LOCATION OF THE VERTICES OF THE ENCLOSING TETRAHEDRON TO ENCLOSE THE SUBSPACE OF THE PROFILE TRAJECTORY WITH A MINIMAL VOLUME THAT BEST FITS THE DRIFT CORRECTED DATA REPRESENTED BY THE PROFILE TRAJECTORY, PROVIDING AN ENCLOSING TETRAHEDRON, THE VERTICES OF WHICH CORRESPOND WITH THE DRIFT-COMPENSATED TARGET FACTORS OF THE ANALYSIS

1660

DEFINE THE NORMED COORDINATES OF THE VERTICES OF THE ENCLOSING TETRAHEDRON RELATIVE TO THE REFERENCE TETRAHEDRON AS THE ENCLOSING-VERTEX WEIGHTING FACTORS USED TO OBTAIN THE DRIFT-COMPENSATED TARGET FACTORS FROM THE NORMALIZED FIRST-FOUR, DRIFT-COMPENSATED PRINCIPAL FACTORS

1670

OBTAIN THE VECTORS GIVING THE DRIFT-COMPENSATED TARGET FACTORS FOR EACH VERTEX OF THE ENCLOSING TETRAHEDRON BY SUMMING THE PRODUCTS OF EACH ENCLOSING-VERTEX WEIGHTING FACTOR WITH THE VECTOR GIVING THE NORMALIZED FIRST-FOUR, DRIFT-COMPENSATED PRINCIPAL FACTOR THAT CORRESPONDS TO EACH VERTEX OF THE REFERENCE TETRAHEDRON

Fig. 16

436

OUTPUT ANALYTICAL RESULTS  
SELECTED FROM THE GROUP  
CONSISTING OF A SET OF  
DRIFT-COMPENSATED SCALED  
TARGET-FACTOR PROFILES  
DERIVED FROM THE SET OF  
TARGET-FACTOR WEIGHTING  
FACTORS, AND THE SET OF  
DRIFT-COMPENSATED TARGET  
FACTORS

1700

436

1710

OBTAINTHESETODRIFT-COMPENSATEDTARGET-FACTOR  
PROFILEVALUESBYAPPLYINGTHESETODRIFT-COMPENSATEDTARGETFACTORTOPROFILE  
TRAJECTORYBYASCERTAININGTHENORMED  
COORDINATESOFEACHPOINTONTHEPROFILE  
TRAJECTORY,I.E.TARGET-FACTORWEIGHTING  
FACTORS,FROMTHEENCLOSINGTETRAHEDRONINA  
MANNERANALOGOUTOTFINDINGCOORDINATESOFA  
POINTONQUATERNARYPHASEDIAGRAM

1720

COMPOSEAREFERENCEVECTORBYSUMMINGTHE  
PRODUCTSFROMEDBYMULTIPLYINGTHEVECTORS  
CORRESPONDINGTODRIFT-COMPENSATEDTARGET  
FACTORSBYTHETARGET-FACTORWEIGHTINGFACTORS,  
FOREACHPOINTONTHEPROFILETRAJECTORY

1730

SCALETHEAMPLITUDEOFTHERESULTINGREFERENCE  
VECTORTOOPTIMALLYMATCHTHECORRESPONDINGROW  
VECTORCOMPENSATEDFORTHEFFECTSOFDRIFT

1740

DETERMINEAACCORDINGSCLAFACASSTHESCALAR  
VALUETHATOPTIMALLYMATCHESTHEREFERENCE  
VECTORTOTHEROWVECTOR

1750

MULTIPLYTHISSCALAFACBYTHENORMED  
COORDINATESOFTHEPROFILETRAJECTORY,I.E.THE  
TARGET-FACTORWEIGHTINGFACTORS,TOOBTAINTHE  
PRODUCTOFEACHINDIVIDUALTARGET-FACTORWEIGHTING  
FACTORTHISCALAFAC,I.E.SCALED  
TARGET-FACTORWEIGHTINGFACTORS

1760

OUTPUTORDISPLAYTHEPROFILESASASETCURVES  
CORRESPONDINGTOSCALEDTARGET-FACTOR  
WEIGHTINGFACTORS,I.E.DRIFT-COMPENSATED  
TARGET-FACTORPROFILEVALUES,FOREACH  
DRIFT-COMPENSATEDTARGETFACTORTHATCONTRIBUTESTO  
APARTICULARROWVECTORREPRESENTEDBYAPOINT  
ONTHEPROFILETRAJECTORY

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Fig. 17

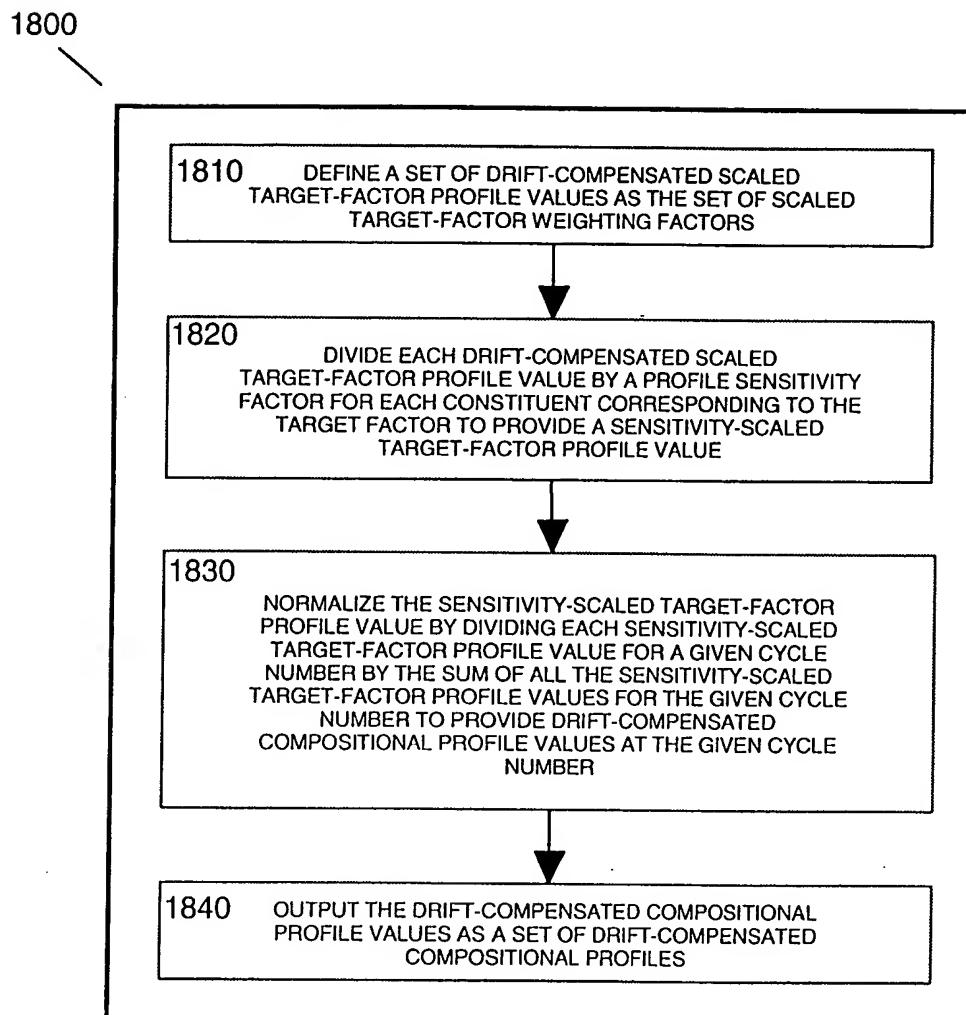
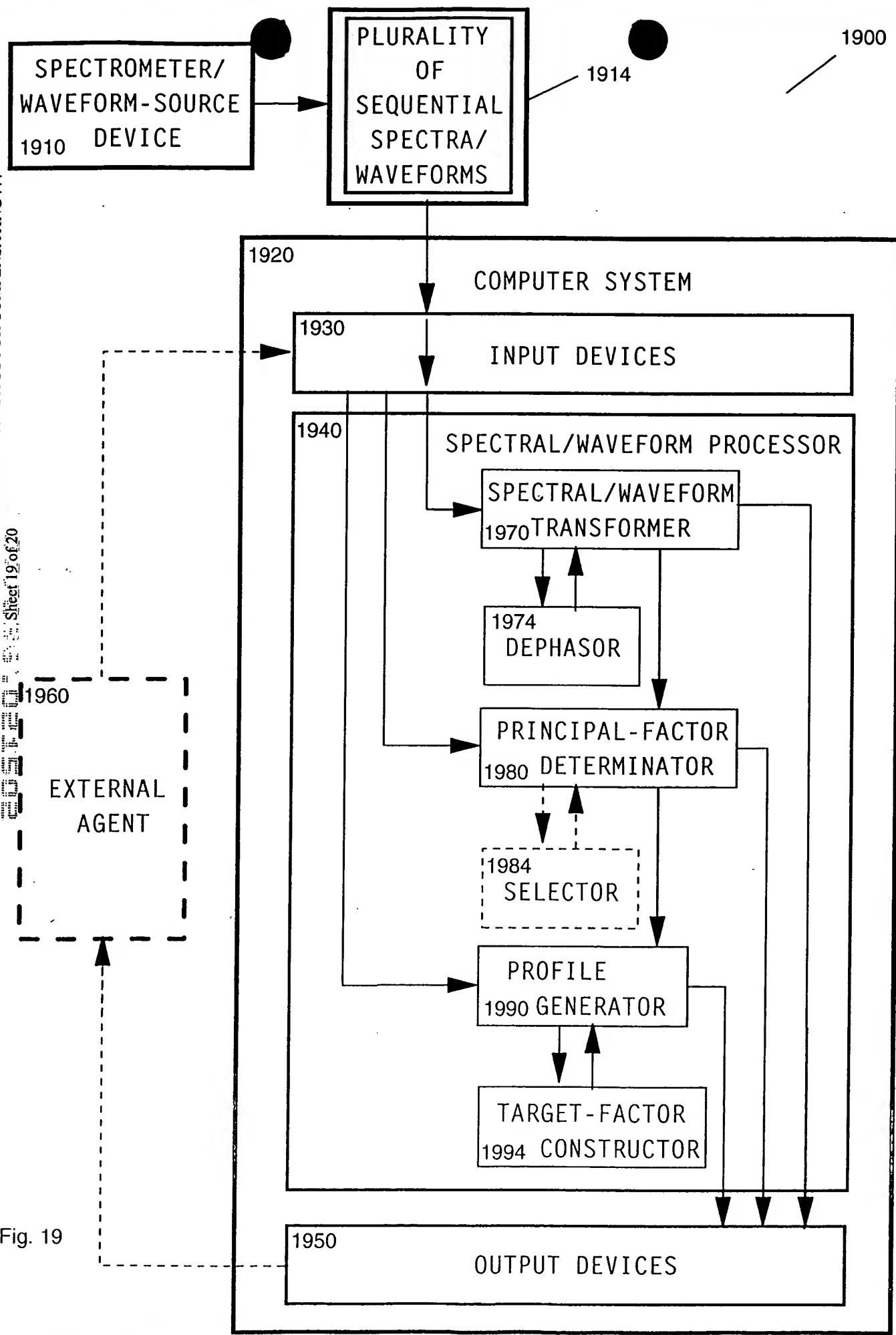


Fig. 18

Fig. 19



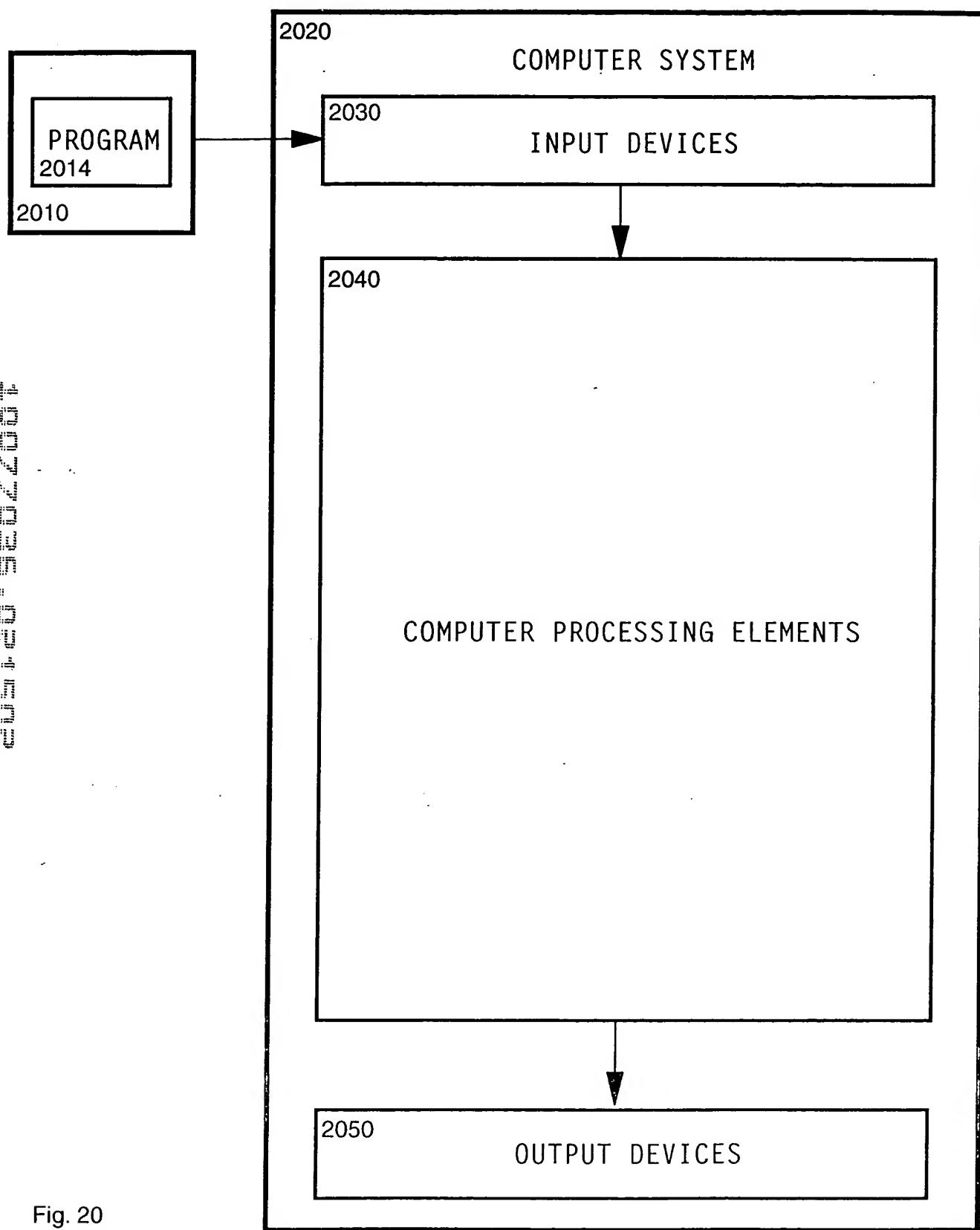


Fig. 20